Long Term Effects of Graduating in a Recession for Economics Ph.D.s

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Introduction

- Bad labor market conditions at the time of labor market entry have large and persistent negative effects on careers (Kahn 2010, Oreopoulos et al. 2012)

- Examine the economics Ph.D. labor market
  - centralized matching systems (Coles et al. 2010) and very low unemployment rate
  - high skilled professionals face rigid promotion decisions early in their careers

- The project investigates whether the initial economic conditions would affect the placement outcomes, and whether it would have left permanent effects on their careers
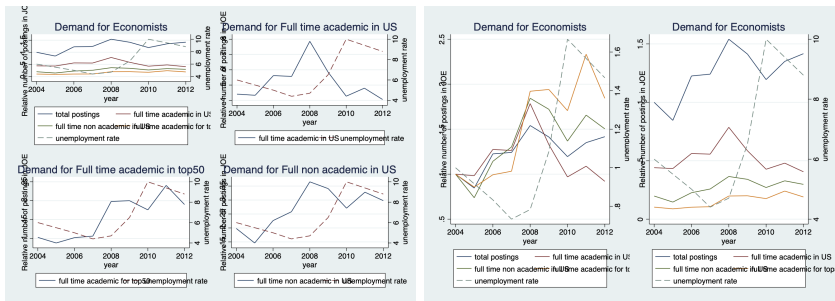 - research on beyond top 10 universities are especially thin

Motivation and Research Question

- Workers graduating into a recession would likely match to a lower level starting jobs than their luckier counterparts (Devereux 2002), and so did econ PhDs from elite schools (Oyer 2006)

- Literature has pointed out that the quality of first job placement is important in explaining the long-term losses (Kwon et al 2010, Oreopoulos et al. 2012)

- Why might econ PhD graduates be sensitive to bad economic conditions in the long run?
  - demand for research is pro cyclical
  - switching careers early is costly, especially for academic economists
    - how do economists develop human capital?
  - evaluate whether the effects would differ by the fields like college majors (Altonji et al. 2014)

Data

- Compile the following data sets to track economists
  - list of job postings from JOE listings in AEA
    - hiring institution, position, JEL classifications from 1975 onward
  - ProQuest Dissertations & Theses Global
    - collect the doctoral dissertations by institutions, year of publications, economics (related) classification, subject codes
    - about 9,000 graduates from top 30 universities in U.S. between 2004 and 2012
  - Scrape CVs on the web or Linkedin experience profiles to collect employment history
  - Use Google scholar and EconLit to collect publication record
- Use Search API and Fuzzy matching algorithm `appendix`
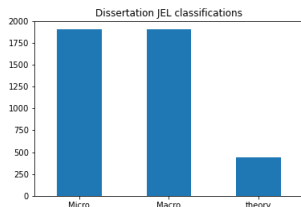- Currently, 4,250 matched graduates

- Number of JOE Listings and US institutions

- Collect the dissertations related with economics between 2004 and 2012 in top 30 universities in US
  - correct the degree date according to CV
  - include non-econ graduates having economics faculty chair
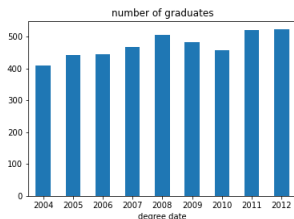
- Financial Economics (G, 17 %) and Labor Economics (J, 12 %) have the highest shares

Econometric Model I

- Consider individual i of graduation cohort c with major field f
  - assume the quality of job market candidates are not related to the economic conditions
- To estimate the effect of initial economic conditions onto the first placements

$$y_{icdf} = \beta \mathrm{ec}_c + \gamma X_i + \xi_d + \theta_f + \epsilon_{icdf} \qquad (1)$$

  - y_i is an index for the initial placements, X_i is an individual controls
  - ec_c indicates macroeconomic conditions for cohort c

Effect of initial labor market conditions on initial placement

	(1)	(2)	(3)	(4)	(5)	(6)
u rate	-0.0209***	-0.0232**	-0.0187**	-0.0164**	-0.0306***	-0.0243**
	(0.00444)	(0.00865)	(0.00678)	(0.00657)	(0.00565)	(0.00980)
female	0.00935	0.00175	0.0130	0.00899	0.00936	0.00773
	(0.0159)	(0.0369)	(0.0103)	(0.0146)	(0.0159)	(0.0148)
usa	0.0610***	0.0554***	0.0644***	0.0610***	0.0609***	0.0637***
	(0.0110)	(0.0147)	(0.0228)	(0.0109)	(0.00887)	(0.0112)
female × u rate				-0.0154		
				(0.0151)		
usa × u rate					0.0224***	
					(0.00654)	
2.ranks						-0.123***
						(0.0135)
3.ranks						-0.120***
						(0.0175)
2.ranks ×u rate						0.0150
						(0.0123)
3.ranks×u rate						0.00204
						(0.0159)
Samples	Full	rank 1	rank2, 3	Full	Full	Full
FX effects	Dep, fields	Dep, fields	Dep, fields	Dep, fields	Dep, fields	fields
N	3986	1702	2284	3986	3986	3986
R^2	0.061	0.035	0.050	0.061	0.062	0.040
F	43.42	17.80	19.39	61.43	35.97	147.3

Standard errors in parentheses
Standard errors are clustered by cohort level
* $p < 0.10$, ** $p < .05$, *** $p < .01$

- To estimate long-term effect, follow Kahn and Oreopoulos et al.

$$y_{icdft} = \beta ec_c + \gamma X_i + \xi_d + \theta_f + \mu_t + \epsilon_{icdft} \tag{2}$$

  - Y_{it} indicates time-varying outcomes for economists
    - tenure in the profession, publication outcomes, time to tenure, mobility
    - here, number of publications in top 50 economics journals (track cumulative num publications over the 9 years)

Effect of initial labor market conditions on the publications

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)
u rate	-0.250***	-0.332**	-0.428**	-0.253**	-0.350**	-0.369**	-0.405**
	(0.0701)	(0.103)	(0.147)	(0.0856)	(0.112)	(0.119)	(0.143)
female	-0.164***	-0.206***	-0.339***	-0.101*	-0.203***	-0.207***	-0.208***
	(0.0378)	(0.0492)	(0.0966)	(0.0510)	(0.0478)	(0.0488)	(0.0611)
usa	-0.292***	-0.405***	-0.429***	-0.375***	-0.405***	-0.405***	-0.382***
	(0.0509)	(0.0656)	(0.0885)	(0.0972)	(0.0656)	(0.0610)	(0.0511)
female×u rate					0.0648		
					(0.0637)		
usa×u rate						0.0847*	
						(0.0433)	
2.ranks							-0.664***
							(0.169)
3.ranks							-0.712***
							(0.130)
2.ranks×u rate							0.137
							(0.0957)
3.ranks×u rate							0.136
							(0.0765)
Samples	Full	NP	NP, rank1	NP, rank2, 3	NP	NP	NP
FX effects	Dep, fields, t	Dep, fields, t	Dep, fields, t	Dep, fields, t	Dep, fields, t	Dep, fields, t	fields, t
N	54724	32723	14107	18616	32723	32723	32723
R^2	0.105	0.152	0.160	0.135	0.152	0.152	0.124
F	14.51	15.99	8.676	6.698	13.89	18.04	115.1

Standard errors in parentheses

Standard errors are clustered by cohort level

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Theory

- Different theories would lead to different expectations about the persistent impact of economic conditions
- The effect of the initial placement is particularly important for economists
- An important feature of many high skill occupations is that human capital accumulation is largely determined during the first decade of one's career
  - problem would be critical at research universities, in which tenure decisions are determined within 5-7 years
- Task-specific human capital model could provide an explanation for cohort effects since workers are forced to develop their human capital according to the tasks assigned

Initial Distribution

- Categorize Occupations
  - (1) Universities in US
  - (2) Research & Professional Organizations in US
  - (3) International Universities & research Organizations
  - (4) Others (private)
- Initial Distribution:
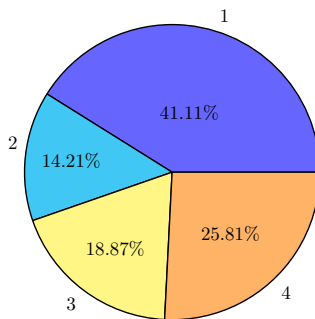
		Current			
		1	2	3	4
Initial	1	70.01	5.84	9.67	14.48
	2	12.58	61.09	6.95	19.37
	3	11.1	3.24	69.08	16.58
	4	9.94	6.56	9.21	74.29

- More than 70 % of academics work at $R1$ university (research-heavy doctoral university)
- Most workers work at the similar category
  - more than 60 % of academics working at other than $R1$ continue to work at the non R1 university
- How are different the workers' tasks?

Teaching Loads

Classes: hours per week teaching credit classes	1-3 hours (%)	4-7 hours (%)	More than 7 hours (%)	Total
Estimates				
Total	22.4	27.8	49.8	100%
Institution: level				
2-year	18.3	23.7	58.0	100%
4-year non-doctoral granting	18.6	23.5	57.9	100%
4-year doctoral granting	27.4	33.1	39.6	100%

NOTE: Rows may not add up to 100% due to rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2004 National Study of Postsecondary Faculty (NSOPF:04).

Computation by NCES QuickStats on 8/10/2021

- Doctoral universities require less teaching
  - the teaching load is higher in state schools

Job description: Natural Language Processing

- Analyze the text in the job descriptions from JOE and CSWEP letters (central bank, consulting firms)
  - Tenured track positions: **research, economics, teaching**, curriculum
  - Research org: **research, economics**, teaching
  - Private: **research**, economics, communication,work, policy, experience, analysis, skills, quantitative,
- Word **research** and **teaching** dominates in Academic positions
- Diverse range of words are captured in private sector positions
  - communication related words are rarely captured in academic positions
- Possibly, human capital would be developed differently

Model

- Build a model to explain why the bad economy would have an permanent impact on economists' career
- Define occupation o as the collection of firms having the same task
- Suppose that task-specific output in a firm f within o is produced by combining multiple tasks, denoted by $j = 1, ..., J$
  - Occupations combine the tasks in different ways, and let $\beta_o^j \in [0, 1]$ be the relative weight on the task j
- a_{iot}^j: worker i's productivity for task j varying by occupation o and time in labor market t
- Worker i's task-specific output Y working at f in o and t

$$\log Y_{ifot}^j = \sum_j \beta_o^j a_{iot}^j + \mu_{if} \text{ where } \sum_j \beta_o^j = 1 \text{ for all } o = 1, ..., O$$

  - β_o^j is the share of time a worker spends on average in the task j in o
  - μ_{if} denotes firm matches between i and f

Model - continue

- a_{iot}^j is determined by a person's initial endowment in each task at entry (α_i^j) and the human capital accumulated in the labor market

$$a_{iot}^j = \alpha_i^j + \gamma_o H_{it}^j \tag{3}$$

  γ_o is the return to human capital on occupation o
- H_{it}^j is the human capital accumulated in task j until time period t

$$H_{it}^j = \lambda_{o'}^j \mathrm{Exp}_{io't} \tag{4}$$

  $\mathrm{Exp}_{io't}$ denotes the previous tenure in occupation o' (to simplify exposition)
- Hence,

$$\log Y_{ifot}^j = \gamma_o \left[\sum_j \beta_o^j \left(\lambda_{o'}^j \mathrm{Exp}_{io't} \right) \right] + \sum_j \beta_o^j \alpha_i^j + \mu_{if} \tag{5}$$

$$\text{where} \sum_j \beta_o^j = 1 \ \text{ for all } o = 1, ..., O$$

Model - continue

$$\log Y_{ifot}^j = \gamma_o \overbrace{\left[\sum_j \beta_o^j \left(\lambda_{o'}^j \mathrm{Exp}_{io't} \right) \right]}^{\mathrm{Task}_{iot}} + \underbrace{\overbrace{\sum_j \beta_o^j \alpha_i^j}^{\mathrm{m}_{io}} + \mu_{if}}_{\text{Match quality}} \qquad (6)$$

- Task_{iot} is observable measure of task-specific human capital valued by occupation o
- mc_{io} is the unobserved implying how well an individual is matched to the occupation given her ability
- Value of Task-tenure depends on previous occupations
- When entering the market, there is no human capital accumulated
  - Initial placement effects are reflected through the match quality
  - Assume the match quality with a firm is conditionally random
  - Match quality with occupation would be affected by economic condition

Incorporating Initial Economic Condition

Assumption 1. most workers are research-oriented

$\alpha_i = \left(\alpha_i^1, ..., \alpha_i^J \right) \equiv m(X_i) + e_{it}$, where $\max \alpha_i^1 > \max \alpha_i^j$ for all $j \neq 1$

- $j = 1$ indicates economics-research task

Assumption 2. Finding an reserch-heavy occupation is procyclical

Demand from research university is procyclical

- The two assumptions yields the following theorem

Theorem 1. mismatch arises during the bad times at the entry

If $u_t < u_{t'}$, then $\mathbb{E}_i \left[m_{io} \mid u_t, \sum_j H_{it}^j = 0 \right] > \mathbb{E}_i \left[m_{io} \mid u_{t'}, \sum_j H_{it'}^j = 0 \right]$

- consistent with Bowlus (1995)
- Now consider the economist' labor market characteristics and production dynamics

Up-or-front Work condition

Assumption 3. Job switching is prohibited over the few years

Economists work under up-or-front policy

Corollary 1. Short-run hysteresis

If $u_t < u_{t'}$, then $\mathbb{E}_i\left[Y^1_{ifot} \mid u_t, X_i\right] > \mathbb{E}_i\left[Y^1_{ifot} \mid u_{t'}, X_i\right]$

- The gap is driven by the two channels
  - unfavorable economic conditions result in mismatch
  - unfavorable human capitals are developed according to the tasks
- Now consider switching options are available
  - need to take account how accumulated capitals are valued when move

Proposition

For $\lambda_{o'}^j > \frac{1}{J}$, task-tenure is valued more if moves to $\beta_o^j > \lambda_{o'}^j$

For $\lambda_{o'}^j < \frac{1}{J}$, task-tenure is valued more if moves to $\beta_o^j < \lambda_{o'}^j$

For $\lambda_{o'}^j = \frac{1}{J}$ $\forall j$, task-tenure does not change regardless of moving

- How the task tenure is valued depends on the degree of specialization in the source occupation
  - one's tenure is valued more if the target occupation more specializes than the source occupation
  - If the source occupation is very general (close to $1/J$), the direction of moving is hard to predict
- Now consider the implication for job mobility

Mobility Decision

- Workers search over to maximize output
  - assume additively separable utility function,
  - consider decision problem in two period

- Suppose research oriented worker i started working at f' within teaching-heavy o' in first period

- In the next period, suppose a firm f within research intensive o offers to move

- Improvement on match-up qualities and returns to task tenure would make a shift more likely, but there is a loss from the task tenure according to the proposition when move

$$(m_{io} - m_{io'}) + (\mu_{if} - \mu_{if'}) + (\gamma_o - \gamma_{o'}) \operatorname{Task}_{io't} \tag{6}$$
$$> \gamma_o \underbrace{(\operatorname{Task}_{io't} - \operatorname{Task}_{iot})}_{\text{potential loss}} + \underbrace{\tau}_{\text{search cost}}$$

Empirical prediction

$$(m_{io} - m_{io'}) + (\mu_{if} - \mu_{if'}) + (\gamma_o - \gamma_{o'})\,\text{Task}_{io't} \tag{7}$$
$$> \gamma_o \underbrace{\left[(\beta_{o'} - \beta_o)\left(H_{it}^R - H_{it}^T\right)\right]}_{\text{potential loss}} + \underbrace{\tau}_{\text{search cost}}$$

- Potential loss is governed by two factors
  - how similar the tasks between occupation o and o', $|\beta_o - \beta_{o'}|$
    - if the source occupation is very general, there would be no loss
  - how much human capital accumulated from the previous occupations
- If workers' human capital is task specific, possible to predict mobility
  - they are more likely to move to occupations in which they can perform tasks similar to previous occupations
  - occupation switch would get harder if one stay longer
- First term capture the counterfactual of the initial condition
  - if not task specific, more like move to the desired occupation
  - more immobility because of economist' labor market characteristics

Discussion: Hypothesis

Hypothesis

Economists' human capital is task specific, and the occupations are specialized in different ways

- the impact of the initial mismatch would be persistent because the workers tend to stay at the initial occupations or the similar occupations

Current work

- Update the occupation categories
  - find data to supply intuition of what workers do in those occupations
- Explore instrument: the number of job postings on JOE
  - exogenous variable affecting the initial placements and later outcomes only through the initial placement
- Improve long-term outcome measures

Fuzzy matching

- One challenge of the task is scrape text data from the source document and convert them into suitable format
  - Scraping - use various APIs
    - might involve legal issues $\rightarrow$ commercial APIs
- Bigger challenge is that there are same institution but were taken as different forms
  - CV, dissertations, rank data, Journal entry
  - matching economists' names are even more complicated
- Employ learning methods from data science literature
  - data matching or fuzzy matching (probabilistic data matching)

Steps

- N-grams: a set of co-occurring words within a given sentence (Wang et al. 2006)
  - collect the words in the sentence having more meaning
- TF-IDF: count the word occurs in each document
  - evaluate how important a word is and (learning)
    - very important since the names have only a few words
  - long computing time ...
- Cosine similarity: how close the two sentences is
- Matching rates vary
  - JOE in US institutions: 89%
  - All institutions: 70%